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PRINCIPLES OF DIET

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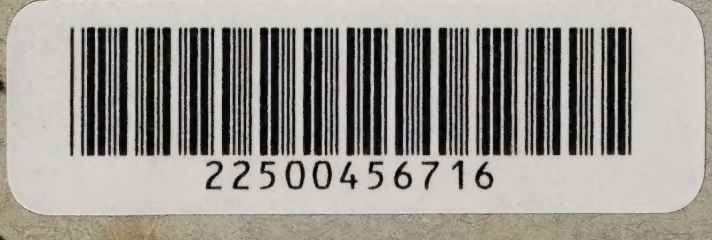

PRINCIPLES OF DIET

By ERIC PRITCHARD, M.A., M.D., M.R.C.P.

Both from the national and from the individual point of view, the question of diet is one of the most important of those which confront us to-day.

Wars have been won and lost by successful and unsuccessful commissariat arrangements; nations have been driven to revolution and anarchy by starvation; while temperaments and dispositions are intimately dependent on the character of the food. The whole outlook of life, a man's policy in public and private life, can be entirely altered by dyspeptic conditions due to dietetic indiscretions.

Food is just as essential for the carrying on of the activities of the human body as fuel is for the performance of the mechanical work of an engine; food, indeed, not only serves as the exclusive source of energy in the human body, but it also supplies the material for growth and repair, and for the manufacture of the many secretions on which the smooth working of the bodily functions depends. Stated quite briefly, food subserves the following purposes; it provides:

1. The sources of energy for the performance of work and for the production of heat.
2. The material for growth and repair.
3. The material for the elaboration of secretions.

You cannot extract more work or heat out of the human body than is represented by the energy-value of the food put into it, on the other hand you do not necessarily get full value; there may be varying degrees of waste. It is one of the greatest mistakes to believe that you can extract work out of the human machine or restore strength by the mere supply of food; you cannot do one or the other without food, but you can no more make the human machine work

by cramming energy into it than you can make a damaged motor-car move by pouring petrol into its cistern.

Since no two individuals give the same output of work or have exactly the same requirements for growth, repair, and heat production, it is clear that the food requirements in no two cases will be exactly the same, nor is it absolutely essential that the exact amount of food required should be supplied, for the human body has great reserve powers for dealing both with excess of food and with a deficiency; but each human engine works most easily and with least wear and tear when the intake exactly corresponds in energy-value to the output.

The actual output of energy of each individual can be expressed in figures—*i.e.*, in units of work (foot-pounds), or in units of heat (calories). If the output is found to represent a certain number of foot-pounds or calories, the intake of food cannot have a smaller energy-value.

A calorie is the amount of heat which is required to raise the temperature of 1 litre or 1 kilogramme of water, by 1 degree Centigrade. One calorie is the equivalent of 2,975 foot-pounds. It is not difficult to calculate the output of any individual either in calories or in foot-pounds; it has been estimated that on an average the output of—

1. A needlewoman	is	2000	calories	per	diem.
2. A machinist	,,	2100–2300	,,	,,	,,
3. A domestic servant	,,	2500–3200	,,	,,	,,
4. A washerwoman	,,	2900–3700	,,	,,	,,
5. A child 10 years of age	,,	1800	,,	,,	,,

In order that the energy requirements of such individuals may be adequately supplied, their diet must contain a corresponding amount of potential energy. Each food possesses a different calorie- or energy-value; for instance, the calorie value of bread is 76 for every ounce of weight, of meat 57 calories, of butter 219 calories, of cheese 121 calories. From this it may be calculated that the 2,000 calories required by a needlewoman in the 24 hours could be supplied by some 39 oz. of bread, some 52 oz. of meat, some 14 oz. of

butter, or some 25 oz. of cheese. Although such quantities of food would indeed afford theoretically all the energy-value required, they would not constitute practical dietaries because they would fail to fulfil certain other requirements which may be stated briefly as follows:

A sound physiological dietary must fulfil the following requirements; the more completely and accurately it does so, the better the diet, and by these criteria the value of a dietary may be judged:

1. The diet must supply the required number of calories.
2. The relative proportions or "balance" of the main constituents—*i.e.*, the proteins, the fats, and the carbohydrates—must be arranged in a more or less definite manner in accordance with the age, habits, and output of work of the individual.
3. The food must be presented in a form capable of digestion.
4. It must possess an adequate supply of certain so-called accessory food-factors, such as vitamines, lecithin bodies, extractives, salts, etc.
5. Certain conditions, such as those connected with taste, cooking, appearance, custom, etc., must be fulfilled, for the psychological factor cannot be ignored.

With regard to these essential conditions a few explanations are necessary. First, as regards quantity. Both an excessive and a deficient supply of food carry with them certain disadvantages. All excess in energy-value over and above that which is required for physiological purposes, such, for instance, as for the output of work and the production of heat, must be disposed of by the organism in some way which does not subserve useful purposes, in other words in a pathological manner. The overfed individual either grows too fat, or he produces too much heat, or he gets rid of the excess by some other means such as by diarrhœa or vomiting, but in whatever manner he may succeed in disposing of the excess, he never does so without paying some penalty,

great or small; but the things that excess of food never causes are: (1) An increase of the output of useful, honest work; (2) an improvement in health; or (3) an accession in strength.

On the other hand, with a deficit in the food supply, the output of work must be restricted, or the individual must draw on his reserves and tissues to provide the sources of energy. In simple words, the overfed person must restrict his intake, or increase his output by exercise or work, while the underfed individual must eat more or take less exercise, if he wishes to remain in good health.

With respect to the maintenance of balance between the amount of proteins, fats, and carbohydrates consumed, it may be stated generally that each person has his own particular optimum, which will depend on various circumstances. Speaking quite generally, proteins are required for growth and repair, fats are specially required for heat production, and carbohydrates for work and physical exercise. If the balance in different varieties of milk are examined, it will be seen that in those cases in which growth is rapid the proportion of protein is high, as, for instance, in the milk of the rabbit and dog. Where the young animal is naturally exposed to severe degrees of cold, as in the case of the young of the whale, the dolphin, and the reindeer, the percentage of fat in the milk is extremely high. Young animals who are very active as a rule are provided with a correspondingly large amount of carbohydrate. Although hereditary habits greatly modify these general principles, none the less it may be accepted as a fairly accurate statement that human beings require more proteins when they are young and growing rapidly than when they have ceased to grow, or are actually atrophying in old age; that they require more fat in cold climates and in cold weather than in hot climates and in hot weather, and that the more physical exercise they take the greater is their need for carbohydrates.

In the relative proportions of proteins, fats, and carbohydrates in human milk, Nature has shown us what may be considered to be the ideal balance during the period of most

rapid growth—viz., in infancy. This balance is protein 2 parts, fat 3·5 parts, carbohydrates 7 parts—that is to say, 2 parts of protein to about 10 parts of combined non-nitrogenous food—or, reduced to its simplest terms, the ratio is as 1 to 5. This ratio must be slightly altered as the infant grows into a child and takes more exercise, and the alteration must be made in the direction of an increase in the amount of the non-nitrogenous elements. One of the chief mistakes existing in our British dietaries for children is that the nitrogenous-non-nitrogenous ratio instead of being 1 to 5 or 1 to 6 is often 1 to $3\frac{1}{2}$ or 1 to 4; such excessive nitrogenous dietaries, which are chiefly due to preponderating quantities of cows' milk, are responsible for many nutritional disturbances.

The proportion of fat to carbohydrate is in human milk as 3·5 to 7, or as 1 to 2. This proportion, though correct for infants, is in the case of older children and adults too high with respect to the proportion of fat. For normal adults doing average amounts of work and exposed to average degrees of temperature, the proportion of fat should be about 1 part by weight to about 5 or 6 parts by weight of carbohydrate. There can be no doubt that, making full allowance for racial and individual habits, a maintenance of a correct balance is one of the essential conditions for health. It is impossible to convert omnivorous animals such as we are into carnivorous, herbivorous, or graminivorous individuals—that is to say, into individuals subsisting on a one-sided diet—without doing considerable violence to their metabolic habits—in other words, without causing considerable injury to nutrition—and yet this is exactly what certain food faddists attempt. Food cranks and their methods are to be avoided.

As regards the digestibility of food, it must be clearly understood that all articles of diet which resist the normal, physiological action of the digestive juices eventually become food for the putrefactive and fermentative bacteria in the bowel, and in so doing become poisons in the system. Whether food can be normally digested or not depends partly on quantity and partly on quality. Food which

in itself is perfectly capable of being digested may, if given in excess, prove a source of indigestion. Certain hard varieties of food may be easily digested if adequately masticated, and mastication is an essential condition of good digestion; the importance therefore of the early training in the habit of mastication is apparent. Unfortunately a large number of children acquire the habit of bolting their food by having their carbohydrate food presented to them in the form of paps, milk puddings, and porridge which require no mastication and are swallowed whole, while meat and fish are given them in a minced or pounded condition. It cannot be emphasized too strongly that for satisfactory digestion a sufficient interval must be left between meals. Four meals a day is the outside limit for a child over one year of age, three meals a day are in the majority of cases preferable.

As regards the accessory food factors, it may be stated generally that these are of essential importance for good nutrition. Of recent years great attention has centred round the so-called vitamines, so much so indeed that there is a genuine danger of the public coming to believe that they are the only really important elements in the diet. It cannot be too clearly stated that although without an adequate supply of these essential elements good health is impossible, none the less they can in no way compensate for breaches of any of the fundamental principles already enumerated as being necessary for a physiological dietary. Although this classification is by no means final the vitamines at the present time recognized are arranged in the three following groups:

Firstly, those which prevent the development of symptoms of scurvy, the so-called antiscorbutic vitamines which are found in most fresh vegetable and fruit juices. These vitamines appear to be very perishable; they are destroyed by prolonged heating or keeping. For this reason no diet can be considered physiologically adequate without its complement of fresh food of vegetable origin.

The second class of vitamines possesses properties which

appear to be connected with growth and development; without them young animals cease to increase in weight, and soon develop serious symptoms of malnutrition. Provisionally the term " fat-soluble A " factor has been applied to these bodies; they exist in animal fats, but appear to be absent from the great majority of oils of vegetable origin, hence animals, and especially young growing animals, cannot subsist exclusively on vegetable fats. It appears that these particular vitamines are obtained by the animal, in whose fats they are stored up, from leaves and grasses, hence individuals or animals who consume a sufficiency of such green foods need not rely on animal fats as a source of this vitamine, but such individuals—as, for instance, babies who cannot digest green foods of this nature, and thus obtain a supply of this vitamine—cannot remain in health on diets in which the fats are supplied in the form of vegetable oils; they must have animal fats.

The third class of vitamines are found in the germs or cortical parts of cereal grains, and are essential for the prevention of certain nervous diseases, such as beri-beri and pellagra, which develop when cereal foods, such as rice or maize, which have been too carefully refined, and from which the cortical layers have been removed in the processes of polishing or milling, are consumed in large quantities. Quite probably many individuals suffer from minor degrees of malnutrition, owing to the exclusive consumption of white bread and highly refined flours; for this reason in those cases in which much bread is consumed it is most desirable that wholemeal bread should be substituted for the more highly refined varieties.

There are probably other accessory factors in addition to vitamines which are necessary to complete a physiological diet —such, for instance, as the lecithin bodies, cholesterol, and certain extractives. Such bodies are present in milk, and they are not likely to be absent from any adequately varied diet, even though the latter includes no milk. It is in onesided and monotonous dietaries that the consumer is liable to suffer from want of them, and to develop some deficiency disease

or symptom. There can be little doubt that a large section of our urban population suffer seriously from an inadequate supply of fresh food, particularly of green vegetables, raw salads, and fruit, and that they exist too exclusively on preserved foods, meat, and highly refined flours.

The psychological factor in diet is most important; tastes for rich and unwholesome foods, as well as antipathies for wholesome articles of diet, are very easily acquired by children by indiscreet remarks and actions on the part of parents, nurses, and others who manage or associate with them. Likes and dislikes of food are practically always acquired and perpetuated by "suggestion"; they are not inherited. It is true that there are certain idiosyncrasies of a definitely physical kind which certain individuals possess in respect of certain particular kinds of food—for instance, some people cannot eat shellfish, almonds, or strawberries without suffering from severe symptoms of a constitutional kind, or developing nettlerash or other skin troubles.

In conclusion, it may be once again stated that for a diet to be physiological it must fulfil definite requirements in connection with caloric value, balance, digestibility, times of consumption, and certain accessory and psychological factors.

Mistakes in diet are responsible for an immense amount of sickness and disease; they occur as the result of ignorance more than as the result of economic or social conditions. It is too commonly believed that correct dietaries can be arranged by a simple compliance with taste and customs. Many people appear to believe that scientific adjustments, based on the principles above enumerated, are useless and unnecessary. Until, however, the scientific study of dietaries and dietetics is more seriously taken up by the medical and nursing professions the populace as a whole will continue to suffer from many unnecessary forms of malnutrition.

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